Further Options for Sampling/Decontamination of Plum Island Building 257 for NY State Dept of Environmental Conservation

Background

The US Department of Homeland Security (USDHS) is planning on some combination of sampling and/or decontamination of Building 257 at the Plum Island Animal Disease Center (PIADC). The building was ostensibly only used for testing with the viral and bacterial animal diseases listed in the document "Building 257 Biorisk Assessment", which did not include *Bacillus anthracis*. There is still, however, a long-standing public perception that *B. anthracis* was indeed used at the facility, although no documentation from either the Department of Defense or USDHS has been found to support that allegation.

We are working under the assumption that viral and bacterial stocks and source material, stored as lyophilized preparations, were removed from the building during decommissioning. Lyophilized stocks of virus, bacteria, and spores have been known to maintain persistence for 60 years or more [1].

There has been no documented environmental sampling for any of the agents ostensibly used in Building 257, neither when the building was in use nor after the building was abandoned in the late 1990s.

Viral Agents

It is highly unlikely that any viral agents will have persisted in the building since it was last used in the late 1990s. There are published data on persistence of viruses in various media and on various surfaces, and even under conditions most favorable to viral persistence, spans of time from days to weeks, with the maximum times on the order of a year seem to be the longest times that viruses remain viable when bound on surfaces or absorbed into media.

The viral agents that were tested when Building 257 was in operation were primarily measured in blood and tissue samples in the test animals; there are not validated methods for measuring them on environmental surfaces such as wood, paint, concrete, and other materials that are found in Building 257, particularly coupled with the dust, dirt, and grime of 20 years deposited on the surfaces.

Bacterial Agents

The bacterial agents that were tested in Building 257, as described in Table 1 of the Biorisk Assessment document, also do not likely have sufficient environmental persistence to have survived for 20 years. Like the viruses, the bacterial agents were primarily measured in blood and tissue samples, and there are no validated methods for measuring them on environmental surfaces such as wood, paint, concrete, and other materials found in Building 257, particularly coupled with the dust, dirt, and grime of 20 years deposited on the surfaces.

Spore-Formers

There is no record of *B. anthracis* ever being used for experiments in Building 257. Spore-forming organisms, such as *B. anthracis*, *Stachybotrys* (mold), or *Clostridium* species, if they were present and survived the surface decontamination procedures that were performed on Building 257 following its closing (or were transported in afterwards), would likely have survived the intervening years. It is also

possible, but not likely, that *B. anthracis* might be present due to natural animal activity on the island – the building was open to ambient conditions and naturally-occurring organisms might have gotten into the building through causes completely unrelated to the animal disease research activities that occurred in Building 257. The environment, climate, and soil type of Plum Island is not conducive to *B. anthracis* and no human or animal occurrences have been reported on the island. Most reported cases in the mid-Atlantic/North Eastern United States have been from animal meat, skin, or hair processing activities. Mold spores could be present due to the lack of environmental controls in the defunct structure. There are environmental methods for sampling and analysis of some of these organisms, although the dirt and grime may present challenges.

Other

There is apparently asbestos and lead paint in Building 257, which have their own issues to be dealt with, regardless of any issues related to microorganisms. One issue that needs to be addressed is the large quantity of standing water in the basement, assuming the basement is still flooded. There are questions about whether the basement and the standing water are contaminated (most likely not with laboratory agents). Depending on this determination, there are issues about whether the basement is going to be pumped out, sampled, decontaminated, etc. Can the basement be sealed off if some sort of vaporous decontamination is utilized?

Sampling

Building 257 has approximately 42,000 square feet. If sampling were to occur, depending on the sampling strategy used, a large number of samples might potentially be required to perform a probabilistic sampling approach if confidence levels are to be assessed. The Visual Sampling Plan (VSP) software can be used to generate a statistical sampling plan based on blueprints for the building.

An alternate approach would be to use targeted sampling, where fewer, but highly focused samples, based on past building usage data, visual observations of building areas, and likely places where contamination may persist, can be used. EPA has been developing a trade-off tool for sampling (TOTS) to aid in the development of sampling plans and is intended to help assess the cost and time of performing the sampling activities associated with that sampling plan.

It is also possible to use a hybrid approach, which might include a partially statistical, partially targeted approach. TOTS allows for statistical sampling plans generated by the VSP software to be imported, then embellished by targeted sampling of specific areas.

TOTS also includes the capability of using innovative emerging sampling approaches that, although are not the prescribed sampling methods that the CDC's Laboratory Response Network specifies, can sample much larger areas to be composited into a single sample. These approaches, including wet-vacuums and robot floor samplers have shown promise in laboratory and field studies.

A key element of any sort of sampling effort is that there must be some decision process that occurs if positive samples come back from the laboratory.

Options

These options are intended to be an expansion of Option 4 and Option 5 from the "Plum Island Writeup r3" document that the EPA team generated in July 2018. The following does not consider issues related

to lead, asbestos, or mold. These issues may need to be addressed separately but are not within the scope of this document.

If public opinion necessitates that something be done, essentially there are 3 choices:

- decontaminate without sampling; BI strips can be used to evaluate decontamination effectiveness;
- sample and take your chances that they all come back negative, but be prepared to decontaminate and do another round of sampling afterwards; and
- decontaminate then sample afterwards to verify that the decontamination worked on anything that might (or might not) have been there.

If sampling is done, there are several options.

- Full probabilistic sampling of entire building to some pre-determined confidence interval (e.g., 90%) for spore formers. Add targeted samples in certain key areas of the building. This option would likely be time-consuming and expensive.
- Limited, targeted sampling of key areas of the building for spore formers. Focus on areas that did not get decontaminated when the building was closed (e.g., vertical surfaces). Focus on areas that animal experiments were performed (e.g., holding pens). If these samples all come back negative, then probability of contamination elsewhere in the building is low. Decontamination would probably not be needed.
- If either sampling option is taken, positive results would need to be followed with a decontamination plan.

If decontamination is done, there are several options.

- All the non-fumigation decontamination options would require that something be done with the peeling paint and debris i.e., removal of the peeling paint and debris in addition to decontamination of debris.
- Fumigation: chlorine dioxide, formaldehyde, hydrogen peroxide, methyl bromide, or other fumigants.
- Liquids on surfaces by spraying or fogging: bleach, chlorine dioxide, hydrogen peroxide, peracetic acid, or other oxidizing liquid solutions.
- Each of these decontamination options has their pros and cons. There is an EPA decontamination selection tool (DeconST) that can help with decision making between these options.

The last option would be to do a combination of decontamination followed by sampling.

- Depending on the confidence in the decontamination process you can adjust the number of samples that follow.

Summary

Based on the lines of evidence, key among them are:

- Maximum of one year that viruses remain viable when bound to or absorbed on media;
- Bacterial agents that were tested in Building 257 are not likely to have survived for 20 years; and

- There is no evidence to date, that spore-forming agents were tested in Building 257.

A reasonable approach that includes sampling would be to sample for spore-forming bacteria using both a targeted and a random sampling approach.

- Focus targeted samples on animal holding pens. Using a sampling approach that maximizes the total area sampled;
- With a small percentage of sampling, randomize so that areas throughout Building 257 are represented in the sampling scheme;
- NOTE that if a sampling-based approach is used, then some sort of decision process must be developed to address the consequences of getting positive sampling results (e.g., limited decontamination followed by another round of sampling; decontamination using process monitoring and lines of evidence, possibly followed by additional targeted sampling; decontamination using biological indicator (BI) strips as an indicator of decontamination effectiveness, etc).

Alternately, another reasonable approach would be:

- Forego sampling altogether and proceed with decontamination such as by using low concentration vaporous hydrogen peroxide [2]; it may be necessary to get a crisis exemption from EPA's pesticide office; prior to decontamination, something may need to be done with the large quantity of standing water in the basement; it may also be necessary to do some sort of surface treatment on certain materials that are known to reduce the efficacy of a given decontamination technology, depending on what decontamination technology is used (e.g., wood and unsealed concrete in the case of VHP, which serve as a sink for the decontaminant and may reduce its effectiveness);
- Utilize strategically located biological indicator (BI) strips to assess the effectiveness of the decontamination process. This would assess the ability of the decontamination process to have killed spore-forming bacteria without the complications associated with sampling for target organisms that have no validated method on the surfaces in the building, or to sample for target organisms that were not tested in Building 257 but might have opportunistically gotten there through natural means.

References

[1] [HYPERLINK "https://link.springer.com/protocol/10.1007%2F978-1-59745-362-2_2"]

[2] Mickelsen et al., "Low-concentration hydrogen peroxide decontamination for *Bacillus* spore Contamination in Buildings," Remediation. 2019; 30:47–56.